

## **Title: Ecological Functions**

### **Brief Overview:**

The following is a series of activities in which students see patterns and make predictions, organize information, and find regularity in data relating to environmental issues. While the issues are authentic, some of the data has been modified so that it is manageable for students in the fourth and fifth grades.

### **Links to Standards:**

- **Mathematics as Problem Solving**

Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**

Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**

Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**

Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Number Sense & Operations**

Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Patterns & Relationships**

Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.

- **Algebra**

Students will demonstrate their ability to perform algebraic operations and will be able to model algebraic concepts using concrete materials.

### **Link to Science Indicator:**

- Demonstrate an understanding of cause and effect relationships to explain how changes in an organism's habitat are sometimes beneficial and sometimes harmful.

### **Grade/Level:**

Grades 4-5

### **Duration:**

4-5 lessons

## **Prerequisite Knowledge:**

Students should have working knowledge of the following skills:

- copying, continuing, and describing patterns
- building patterns when given a description
- creating patterns
- using the constant function on calculators

## **Objectives:**

Students will:

- identify patterns in function tables.
- create and solve story problems.

## **Materials/Resources/Printed Materials:**

- Baker, Jeannie. *The Story of Rosy Dock*. New York: Greenwillow Books, 1995.
- The Earth Works Group. *The Next Step: 50 More Things You Can Do to Save the Earth*.
- Kansas City, Missouri: Andrews and McMeel, 1991.
- Teacher Resource Sheets #1-6
- Student Resource Sheets #1-4
- “Magic Function Box” (Resource Sheet 1)
- Calculators

## **Development/Procedures:**

### **Magic Function Machine**

- To introduce the concept of function tables, begin by inputting the following cards into the “magic function machine.” (See Teacher Resource Sheet #1 for directions on making this machine and cards.) Cards should be made to show the following words written on opposite sides:

- |                           |                |
|---------------------------|----------------|
| 1. used aluminum foil     | soda can       |
| 2. old newspaper          | paper          |
| 3. plastic six-pack rings | plastic cup    |
| 4. used two-liter bottles | plastic binder |

Record each input and output on a function table and have the students identify what function the magic function machine performed in order to get the outputs (recycling). Write the “rule” on the top of the table.

### **Trash Troubles**

- To provide the students with opportunities to work with mathematical patterns in function tables that have a constant rule, have the students solve the following problem (Student Resource Sheet #1). Use Teacher Resource Sheet #2 as a reference.

- *If the average family disposes of twenty pounds of trash each week, how many pounds will they dispose of in one month? in three months? in twenty-six weeks?*
- Have the students identify patterns in the table. (Patterns in the first column follow a “plus one” rule. Patterns in the second column follow a “plus twenty” rule. In the table, there is a relationship between the first column and the second column of “times twenty.” Thus, the rule for the table is “weeks x twenty = pounds of trash.”)
- Have the students make another table using months in order to find how many pounds of trash a family disposes of in one year.

Week	Pounds of trash
1	20
+1 ↘ 2	40 ↘ +20
+1 ↘ 3	60 ↘ +20
↘ 4	80 ↘
↘ 5	100 ↘

### It's Out of Control!

- Read *The Story of Rosy Dock* by Jeannie Baker to show how rapidly some plants can grow and spread, and how their growth affects their environment. As a link to the science indicator, have the students identify how the introduction of the rosy dock plant into Australia was harmful. Have the students research other plants that have a negative impact on the environment. (Literature/Science connection)

### Oh, Deer!

Model solving the following problem with the students. Use Teacher Resource Sheet # 3 and Student Resource Sheet #2.

- *The deer population has been increasing in Maryland. If there were six deer in Aberdeen the first year, ten deer the second year, and fourteen the third year, and the deer population continued to increase at this rate, how many deer would there be at the end of ten years? in twenty years? Solve the problem and explain in writing how you arrived at your answer.*

### Mint Condition

Model solving the following problem with the students. Use Teacher Resource Sheet #4 and Student Resource Sheet #3.

- *Mrs. Ingalls has planted one mint plant in her garden. At the end of the first summer, there are seven plants. The following year, there are thirteen plants in her garden. If the mint plant continues to grow at this rate, how many mint plants will she have at the end of seven years? fifteen years? Solve the problem and explain in writing how you arrived at your answer.*

Have the students identify ways the rapid growth of the mint plant is impacting the rest of the garden.

### **On Your Own...**

- To assess students' understanding of problem solving using function tables, have the students solve the following problem independently. Use Teacher Resource Sheet #5 and Student Resource Sheet #4.

*In The Next Step: 50 More Things You Can Do to Save the Earth, according to Biocycle, 400 communities started curbside recycling programs in 1989. In 1991, there were 1,000 communities who participated in curbside recycling. If the number of curbside recycling programs continued at this rate, how many communities will have curbside recycling by the year 2000? by 2010? Solve the problem and explain in writing how you arrived at your answer.*

- Have the students develop their own story problem. The story problem should be written so that a function table is necessary in order to solve the problem. Have the students exchange their problems and solve.

### **Performance Assessment:**

Students will be assessed on their ability to solve problems using function tables and in constructing original story problems which use several processes. A scoring tool for this assessment can be found on Teacher Resource Sheet #6.

### **Extension/Follow Up:**

Have the students collect data on the amount of trash their family disposes of in a given time period. Have the students determine a way to display their data. Use the individual data collected to compile class totals. Use the class totals to draw conclusions.

Refer back to *The Story of Rosy Dock*. Use the story line to have the students create original problems that require the use of function tables to solve.

### **Authors:**

Wendy Ingalls  
Shady Spring Elementary School  
Baltimore County, MD

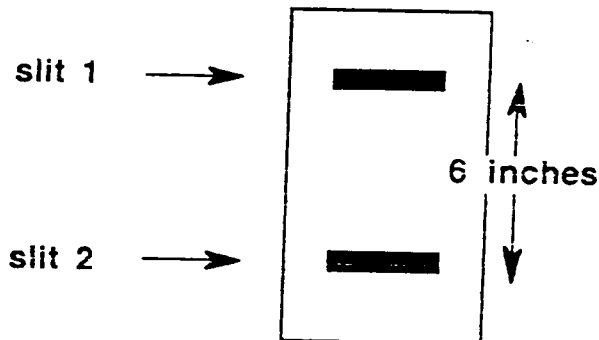
Kathleen Gerwig  
Office of Elementary Education  
Baltimore County, MD

# Magic Function Machine

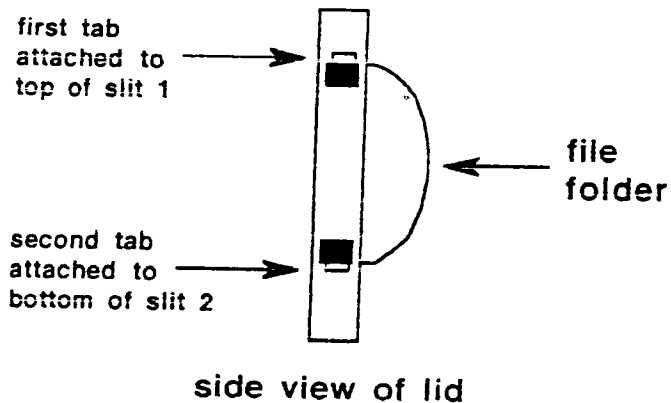
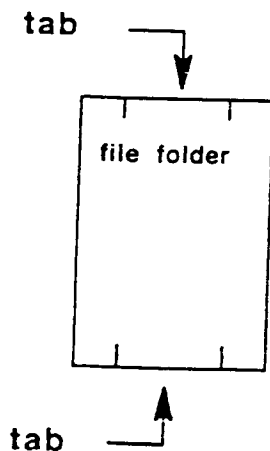
## Materials needed:

- shoe box
- tape or stapler
- index cards
- glue
- file folder
- paper to cover shoe box and lid
- scissors

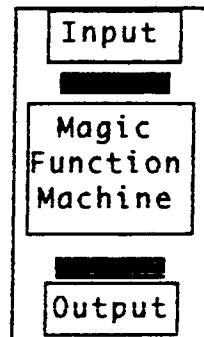
1. Cut two slits approximately 1/2 inch tall by 3 inches wide in the lid of a shoe box. (See diagram.) The slits should be approximately six inches apart.



2. Cut a piece of file folder so that it is as wide as the shoe box, and approximately 12 inches long. Cut a tab on both ends of the file folder so that it will fit into the slits. Position the file folder on the inside of the shoebox lid. Slide the first tab out through the top of slit 1 and tape, glue, or staple the first tab to the top of the lid. Curve the file folder down and slide the second tab through slit 2. Tape, glue, or staple the second tab to the lid, at the bottom of slit 2. See diagrams below.



3. Cover the shoe box and lid with paper and decorate. Put lid on shoe box. Glue the "input" label (below) on top of slit 1, and glue the "output" label (below) on the bottom of slit 2, as shown in the diagram. Glue "Magic Function Machine" label on the top of box.



4. When inserting the cards, place cards into "input" slot face up; they will come out showing the reverse side of the card.

Labels: Cut out and glue to top of shoe box.

**Input**

**Output**

**Magic  
Function  
Machine**

Cards: Cut out and glue the following on opposite sides of index cards.

**used  
aluminum  
foil**

**soda  
can**

**old  
newspaper**

**paper**

**plastic  
six-pack  
rings**

**plastic  
cup**

**used 2-liter  
soda  
bottles**

**plastic  
binder**



## Trash Troubles

If the average family disposes of twenty pounds of trash each week, how many pounds will they dispose of in one month? in three months? in twenty-six weeks?



## Oh, Deer!

The deer population has been increasing in Maryland. If there were six deer in Aberdeen the first year, ten deer the second year, and fourteen the third year, and the deer population continued to increase at this rate, how many deer would there be at the end of ten years? in twenty years? Solve the problem and explain in writing how you arrived at your answer.

Year	Number of Deer
1	6
2	10
3	14
10	42
20	82

Term Number	Constant Difference	What Was Done?	To Get
1      x	4      =	<u>4</u> <u>+2</u> =	6      First term
2      x	4      =	<u>8</u> <u>+2</u> =	10     Second term
10     x	4      =	<u>40</u> <u>+2</u> =	42     Tenth term

RULE:  $N \times 4 + 2$

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Solve the problem and explain in writing how you arrived at your answer.

# Mint Condition

Model solving the following problem with the students.

Mrs. Ingalls has planted one mint plant in her garden. At the end of the first summer, there are seven plants. The following year, there are thirteen plants in her garden. If the mint plant continues to grow at this rate, how many mint plants will she have at the end of seven years? fifteen years? Solve the problem and explain in writing how you arrived at your answer.

Have the students identify ways the rapid growth of the mint plant is impacting the rest of the garden.

Year	Number of Plants
1	7
2	13
3	19
10	43
20	91

Term Number	Constant Difference	What Was Done?	To Get
1	x 6	= 6 +1 =	7 First term
2	x 6	= 12 +1 =	13 Second term
7	x 6	= 42 +1 =	43 Seventh term

RULE:  $N \times 6 + 1$

## Mint Condition

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Solve the problem and explain in writing how you arrived at your answer.

## On Your Own...

In The Next Step: 50 More Things You Can Do to Save the Earth, according to Biocycle, 400 communities started curbside recycling programs in 1989. In 1991, there were 1,000 communities who participated in curbside recycling. If the number of curbside recycling programs continued at this rate, how many communities will have curbside recycling by the year 2000? by 2010? Solve the problem and explain in writing how you arrived at your answer.

Year	Number of Communities
1	400
2	700
3	1000
10	3700
20	6700

Term Number	Constant Difference	What Was Done?	To Get
1	x	300 = <u>300</u> <u>+100</u> ____ =	400 First term
2	x	300 = <u>600</u> ____ <u>+100</u> ____ =	700 Second term
12	x	300 = <u>3600</u> ____ <u>+100</u> ____ =	3700 Twelfth term

RULE:  $N \times 300 + 100$

## On Your Own...

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## Scoring Tool

Uses mathematical vocabulary in explanation.

1 2 3 4 5

Identifies appropriate rule or number sentence.

1 2 3 4 5

Identifies patterns.

1 2 3 4 5

Uses tables, drawings, or diagrams to explain solution.

1 2 3 4 5

Uses complete sentences to express ideas.

1 2 3 4 5